Ventilation planning considerations for the Carrapateena Sublevel Cave

Katie Manns, Johannes Holtzhausen, Andrew Mooney and Leon van den Berg
Introduction

OZ Minerals is a South Australian based modern mining company with a focus on copper.

Their Carrapateena project, located 160km north of Porth Augusta is one of Australia’s largest undeveloped copper deposits.
Background

• 4.25Mtpa Sub-level Caving Operation
• Estimated mine life of 20 years
• Potential to transition for initial SLC to a future 12Mtpa Block Cave
• 1.4km deep with Refrigeration required from ~700m depth
• Max VRT of 66ºC
• Copper-gold orebody with uranium grade, low-levels radon emanation
• Heat and Radon main drivers
• Ventilation on Demand “mine-of-the-future”
Planned Intake Infrastructure

- Conveyor Decline
- Access Decline
- Two $\Phi5.0$m Production FAR
- One stepped $5.5m \times 5.5m$ decline FAR
- 16MW$_R$ Refrigeration
- Two 8MW Bulk air coolers
Planned Exhaust Infrastructure

- Two $\Phi 5.5m$ Production RAR
- One $\Phi 4.1m$ Infrastructure RAR
- Primary airflow capacity - 1180m$^3$/s
Primary Ventilation Strategy

• Push-Pull Strategy
• Conventional surface primary exhaust fans
• Secondary fans installed in tight circuit in FAR
• Positively pressurised levels
Considerations

- Ore body contains low levels of uranium grade
- Radon management for production levels only
- Low levels of radon emanation expected
- Pro-active conservative ventilation design
Radon Management Principles

To manage Radon in underground mines;

• Manage dust as Radon Daughters adhere to dust particles
• Ensure one pass ventilation and minimize series ventilation and re-use
• Ensure adequate air velocity to prevent dust settling in working areas
• Ensure areas such as crushers and ore passes have adequate dust suppression.
Features of the mine – Initial SLC

- 25m vertical sub-level spacing
- Ore is tipped on-level into ore passes
- Two lift SLC with three underground crushers
- Four levels in production
- Two levels in development
- Average of four “chickens feet” per level
Production Level Ventilation

• Maintain RnDP below 2µJ/m³
• 2m³/s continuous flow required
• Impractical to maintain
• Flushing cycle strategy
• VoD system reliant
Ventilation on Demand Strategy

- Variable / dual speed fans
- In-duct flow control valves
- Automated exhaust louvres
- Air quality monitoring
- Equipment tracking
- Pressure differential sensors
Features of the mine – Future block cave

• Increase production to 12Mtpa
• Apex, Undercut and Extraction levels
• El Teniente extraction level layout
• Dedicated exhaust ventilation level
• Peak airflow during development and construction ~1000m³/s
Transitioning from an SLC to a BC

Minimize flow through the cave
  • Manage connections to the ventilation system
  • Barricade connections to the cave where possible

Manage pressure gradient
  • Manage pressure gradient across the cave to discharge radon to non-working areas (not the Undercut and Extraction levels)
Block Cave Development

• Multiple short raises
• No daisy chain or series ventilation
• Ability to flip exhaust direction
• Provision for additional $8MW_R$ during development
Conclusion

• Initial 4.3Mtpa SLC transitioning into a 12Mtpa Block Cave
• Push-pull ventilation strategy
• Positively pressurise levels to manage leakage from cave
• High VRT’s and Radon Management Key Ventilation Drivers
• Radon management during cave development requires a flexible system
• VoD systems to design a “mine-of-the-future”
Any Questions??